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October 22, 1998

EXPRESS MAIL

Box Patent Application
THE ASSISTANT COMMISSIONER FOR PATENTS
Washington, D.C. 20231

TRANSMITTAL OF REISSUE PATENT APPLICATION

Dear Sir:

Transmitted herewith for filing is the patent application for reissue of United States Utility Patent No. 5,566,486, of:

Inventor(s):	Kenneth L. Brinkley
Title:	FIREARM MONITORING DEVICE
Drawings:	3 Sheets
Papers Enclosed:	Specification, 31 Claims (after Preliminary Amendment) and Abstract (Total of 9 Pages); Reissue Declaration and Power of Attorney; Drawings - 3 Sheets; Post Card

A Preliminary Amendment is enclosed.

A copy of the original printed patent is enclosed.

A Statement of Small Entity Status is enclosed.

A Request For Certified Copy Of An Abstract Of Title is enclosed.

The Assistant Commissioner for Patents is hereby authorized to charge payment of the following fees during the pendency of this application or credit any overpayment to Frost & Jacobs LLP, Account No. 06-2226:

The filing fee for this reissue application.

Any additional filing fees required by 37 CFR 1.16 and/or 37 CFR 1.492;

Any deficiency in the patent application processing fees as required by 37 CFR 1.17;

Any deficiency in the issue fee as set forth in 37 CFR 1.18.

The above authorization does not include permission to charge payment of the entire issue fee to our account upon request of a notice of allowance, but only any deficiency in the issue fee paid by our check subsequent to receipt of a notice of allowance.

Five additional copies of this transmittal letter are enclosed for any of these additional charges or credit.

Respectfully submitted

FROST & JACOBS LLP

By: 

Edwin R. Acheson, Jr.
Registration No. 31,808

Enclosures
Filing Fee - 1 copy; Deposit Account - 5 copies

CERTIFICATE OF EXPRESS MAIL MAILING

I hereby certify that a copy of this correspondence is being deposited with the United States Postal Service on October 22, 1998, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number TB807088370US, addressed to the Commissioner for Patents, Washington, D.C. 20231-0001.

Patentee:	Kenneth L. Brinkley	**Attorney Docket No.**
Patent No.	5,566,486	
Issued:	October 22, 1996	
For:	FIREARM MONITORING DEVICE	

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.27(a)) – INDIVIDUAL

I hereby declare that I am an individual acting on my own behalf.

I hereby declare that I qualify as a small entity as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of title 35, United States Code.

I hereby declare that rights under contract or law with regard to the invention, entitled , remain with me as the undersigned inventor described in:

☒ The specification filed herewith

☐ Application Serial No. _____, filed _____

If the rights held by the above-identified individual are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

*NOTE: Separate verified statements are required from each named person, concern organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

NAME_____

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I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that all statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code, and that such willful false statement may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is detected.

NAME OF PERSON SIGNING Kenneth L. Brinkley
ADDRESS OF PERSON SIGNING 180 Barnwood Drive
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SIGNATURE K L Brinkley DATE 10-22-98

583493.01

PATENT

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

Patentee:	Kenneth L. Brinkley	:	Paper No:
		:	
Patent No.:	5,556,486	:	Group Art Unit:
		:	
Issued:	October 22, 1998	:	Examiner:

For: **FIREARM MONITORING DEVICE**

REISSUE APPLICATION
PRELIMINARY AMENDMENT

THE COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

Dear Sir:

Please amend the above patent as follows:

IN THE TITLE

After "FIREARM" insert --AND IMPULSE--.

IN THE SPECIFICATION

At column 1, line 61, after "4,146,987" insert --to Hudson et al--.

At column 2, line 15, change "in" to --and--.

At column 2, line 64, change "an" to --art--.

At column 2, line 65, after "description", insert --,--.

At column 4, line 24, after the first occurrence of "by", insert --the--.

At column 6, line 48, change "26" to -- 28--.

At column 6, line 49, change "7" to --48--.

IN THE DRAWINGS

In Figure 2, add the numeral 30 as indicated in red in the attached drawing. Support for this change is found at column 5, lines 18-19.

IN THE CLAIMS

Please amend the claims as follows:

1. A firearm monitoring device for [attaching to] use with a firearm, [said firearm having a firing end and a grip end, and] said firearm being susceptible to recoil in a first direction when discharged, comprising:

a) [first means for creating a] an inertia sensor configured to generate at least one first signal in response to substantially each [recoil] discharge of said firearm, said inertia sensor comprising a moveable mass resiliently biased in a direction substantially opposite said first direction; and

b) [second means for receiving each said first signal and generating] an electrical circuit configured to receive said at least one first signal generated by said inertia sensor and generate a second signal indicative of the number of said firearm discharges [first electrical signals received by said second means;

wherein said first means comprise an inertia switch comprising a movable mass; and

wherein said mass is resiliently biased toward the firing end of the firearm].

5. The device of claim 1, wherein the movement of said mass [being] is generally confined to movement along a straight line.

7. The device of claim 1, wherein said [second means include means for counting] electrical circuit is configured to count down by one in response to each said firearm discharge [first signal], beginning from a predetermined number.

8. The device of claim 7, wherein said predetermined number can be changed [second

means include means for changing said predetermined number].

9. The device of claim 1, wherein said [second means include means for maintaining] electrical circuit is configured to maintain a total count of the number of said firearm discharges [first signals received from said first means].

10. The device of claim 1, wherein said [second means comprise] electric circuit comprises a microcontroller [adapted to count each said first signal received by said microcontroller].

11. The device of claim 10, wherein said [second means further comprise] electrical circuit further comprises a communication port, wherein information may be stored in and accessed from the microcontroller via the communication port.

13. The device of claim 1, wherein the inertia [switch] sensor comprises a substantially cylindrical housing and a spring.

14. A firearm in combination with a monitoring device, [said firearm having a firing end and a grip end, and] said firearm being susceptible to recoil in a first direction when discharged, said monitoring device comprising:

a) [first means for creating a] an inertia sensor configured to generate at least one first signal in response to substantially each [recoil] discharge of said firearm, said inertia sensor comprising a moveable mass resiliently biased in a direction substantially opposite said first direction; and

b) [second means for receiving each said first signal and generating] an electrical circuit configured to receive said at least one first signal generated by said inertia sensor and generate a second signal indicative of the number of said firearm discharges [first electrical signals received by said second means;

wherein said first means comprise an inertia switch comprising a movable mass; and wherein said mass is resiliently biased toward the firing end of the firearm].

15. The combination of claim 14, wherein said firearm includes a bore through which a round of ammunition is discharged, and the movement of said mass [being] is generally confined to movement along a straight line generally parallel to said bore.

16. The combination of claim 14, wherein said [second means include means for counting] electrical circuit is configured to count down by one in response to each said firearm discharge [first signal], beginning from a predetermined number.

17. The combination of claim 16, wherein said predetermined number can be changed [second means include means for changing said predetermined number].

18. The combination of claim 14, wherein said [second means include means for maintaining] electrical circuit is configured to maintain a total count of the number of said firearm discharges [first signals received from said first means].

19. The combination of claim 14, wherein said [second means comprise] electric circuit comprises a microcontroller [adapted to count each said first signal received by said microcontroller].

20. The combination of claim 19, wherein said [second means further comprise] electrical circuit further comprises a communication port, wherein information may be stored in and accessed from the microcontroller via the communication port.

21. The [device] combination of claim 14, wherein the movable mass is detached and free-floating.

Please add the following new claims:

22. A firearm monitoring device for use with a firearm, said firearm being susceptible to recoil in a first direction when discharged, comprising:

a) an inertia sensor configured to generate at least one first signal in response to substantially each discharge of said firearm; and

b) an electrical circuit configured to receive said at least one first signal generated by said inertia sensor and generate a second signal indicative of the number of firearm discharges, said electrical circuit configured to ignore any signals generated by said inertia sensor within a predetermined time period following the generation of an initial one of a series of said first signals.

23. The device of claim 22, wherein said inertia sensor is an inertia switch.

24. The device of claim 23, wherein said inertia sensor comprises a moveable mass resiliently biased in a direction substantially opposite said first direction

25. The device of claim 22, wherein said inertia sensor is an accelerometer.

26. The device of claim 22 in combination with said firearm.

27. A firearm monitoring device for use with a firearm, said firearm being susceptible to recoil in a first direction when discharged, comprising:

a) an accelerometer configured to generate at least one first signal in response to substantially each discharge of said firearm; and

b) an electrical circuit configured to receive said at least one first signal generated by said accelerometer and generate a second signal indicative of the number of said firearm discharges.

28. A device for counting impulses, each of said impulses being in a first direction, said device comprising:

a) an inertia sensor configured to generate at least one first signal in response to substantially each impulse, said inertia sensor comprising a moveable mass resiliently biased in a direction substantially opposite said first direction; and

b) an electrical circuit configured to receive said at least one first signal generated by said inertia sensor and generate a second signal indicative of the number of said impulses.

29. A device for counting impulses, each of said impulses being in a first direction, said device comprising:

a) an inertia sensor configured to generate at least one first signal in response to substantially each impulse; and

b) an electrical circuit configured to receive said at least one first signal generated by said inertia sensor and generate a second signal indicative of the number of said impulses, said electrical being configured to ignore any signals generated by said inertia sensor within a predetermined time period following the generation of an initial one of a series of said first signals.

30. A device for counting impulses, each of said impulses being in a first direction, said device comprising:

a) an accelerometer configured to generate at least one first signal in response to substantially each of said impulses; and

b) an electrical circuit configured to receive said at least one first signal generated by said accelerometer and generate a second signal indicative of the number of said impulses.

31. A firearm monitoring device for use with a firearm, said firearm being susceptible to

recoil in a first direction when discharged, comprising:

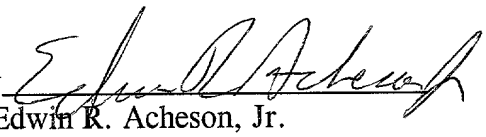
a) an inertia sensor configured to generate at least one first signal in response to substantially each discharge of said firearm; and

b) an electrical circuit configured to receive said at least one first signal generated by said inertia sensor and generate a second signal indicative of the number of firearm discharges, said electrical circuit configured to display compass directions.

Please charge the filing fees for this amendment to Deposit Account No. 06-2226. Any deficiency or overpayment of fees for this Amendment should be charged or credited to Deposit Account No. 06-2226.

Respectfully submitted,

KENNETH L. BRINKLEY

By 

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CERTIFICATE OF MAILING

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FIREARM MONITORING DEVICE

TECHNICAL FIELD

The present invention relates generally to a device for collecting data about the usage of a firearm, and monitoring the number of times a firearm is discharged, and is particularly directed to a device which counts the number of times that a firearm is discharged and delivers information concerning the number of rounds left to discharge and the total number of rounds discharged through the firearm. The invention will be specifically disclosed in connection with a device which counts each recoil of the firearm and then displays the number of rounds remaining, or the total number of rounds discharged.

BACKGROUND OF THE INVENTION

An accurate count of the number of rounds remaining in a firearm is of great importance to the user. With firearms of any type, particularly handguns, it is frequently difficult, if not impossible, to determine accurately the number of rounds remaining in the firearm. This is particularly true when the firearm is being used in an urgent situation, such as those which occur in law enforcement or combat. Usually in such urgent situations, the user is unable to keep track of the number of rounds discharged, and has no time to manually check the status of the firearm.

This difficulty exists in all types of firearms, including automatic and semi-automatic firearms. The problem is particularly acute with automatic firearms where it can be impossible to count at all the number of rounds due to the discharge rate.

Additionally, the total number of rounds fired through a firearm is also of great importance in order to monitor the service life of the firearm so that proper maintenance can be provided. This is true for not only hand held firearms, but also for large or permanently mounted firearms such as that used by the military. With such information, preventative maintenance can be performed before the firearm fails.

To date there have been various attempts to provide monitoring systems which can provide information regarding the number of rounds remaining. For example, U.S. Pat. No. 5,142,805 to Horne et al discloses a handgun in which a microprocessor counts the number of times the gun's slide mechanically engages a switch. Because this device requires a slide, the gun must be configured to interface mechanically with the monitoring device. This requires retooling of the slide, which, in addition to the expense, limits the ability to use this device as an after market application. For each different type of slide, different interfaces must be provided. Such a device is not readily adaptable for each type of handgun, nor can a single design of such a device possibly fit substantially all types of handguns which are available. For example, such a device cannot be easily adapted to revolvers, which do not have slides. Furthermore, automatic and semi-automatic rifles have internal bolts and carriers, lacking the slide required for this device. There are also substantial durability concerns arising out of the mechanical contact between the slide and the switch.

U.S. Pat. No. 4,146,987 discloses a device for large caliber firearms which includes a weight eccentrically mounted at the end of a long shaft. The weight causes the shaft to rotate in response to the firing of the firearm, actuating a mechanical ratchet. Such a device is not suited for small firearms due to its configuration as well as the extra mass present in the shaft and weight. In addition to the

durability problems inherent in such a mechanical counter, this device would probably have difficulty in keeping up with high cycle rates, such as 300 rounds per minute and higher.

There is a need in the art for an accurate monitoring device for counting the number of times a firearm is discharged, particularly which can be easily fitted to all types of firearms, pistols, rifles, shotguns, and which will operate with any type of action, such as single action, double action, semi-automatic and automatic.

SUMMARY OF THE INVENTION

It is an object of this invention to obviate the above-described problems in shortcomings of the prior art heretofore available.

It is another object of the present invention to provide a firearm monitoring device which is responsive to the recoil of the firearm.

It is yet another object of the present invention to provide a firearm monitoring device which can provide a count of the total number of rounds discharged through the firearm.

It is another object of the present invention to provide a firearm monitoring device which can provide an output as a visually or audibly perceptible display or as a feed to a data collection system such as a computer.

It is still a further object of the present invention to provide a firearm monitoring system which can be used on a variety of different models of firearms with no or minor adaptations.

It is yet a further object of the present invention to provide a firearm monitoring system which includes a display which can be easily viewed, especially at night or in low light situations with minimal loss of night vision.

Additional objects, advantages and other novel features of the invention will be set forth in part in the description that follows and in part will become apparent to those skilled in the art upon examination of the following or may be learned with the practice of the invention. The objects and advantages of the invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

To achieve the foregoing and other objects, and in accordance with the purposes of the present invention as described herein, there is provided a firearm monitoring device having first means which generate a first signal in response to each recoil of the firearm and second means which receive the first signal and generate a signal which is indicative of the number of first signals received by the second means. More particularly, a firearm monitoring device having an inertia switch, which is mounted to the firearm, generates a signal in response to recoil of the firearm. The signal is counted by a microcontroller which generates an output signal for delivery to a display or data collection device. The output signal can indicate the number of rounds left to be discharged, based on an initial number preset by the user, and can indicate the total number of rounds discharged by the firearm during its life. Additional controls are provided which allow the user to temporarily decrease the beginning number for the countdown.

Still other objects of the present invention will become apparent to those skilled in this an from the following description wherein there is shown and described a preferred embodiment of this invention, simply by way of illustration, of one of the best modes contemplated for carrying out the

invention. As will be realized, the invention is capable of other different embodiments, and its several details are capable of modification in various, obvious aspects all without departing from the invention. Accordingly, the drawings and descriptions will be regarded as illustrative in nature and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings incorporated in and forming a part of the specification illustrate several aspects of the present invention, and together with the description serve to explain the principles of the invention. In the drawings:

FIG. **1** is a diagrammatic, partially exploded perspective view of a firearm monitoring device according to the present invention with a housing shown in dashed lines.

FIG. **2** is a fragmentary, diagrammatic side view of the firearm monitoring device of FIG. **1**.

FIG. **3** is a diagrammatic perspective view of the firearm monitoring device of FIG. **1** with a housing.

FIG. **4** is a diagrammatic perspective view of an embodiment of the present invention incorporating an integral hand grip.

Reference will now be made in detail to the present preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in detail, wherein like numerals indicate the same elements throughout the views, FIG. **1** shows diagrammatic representations of the various components of a firearm monitoring device constructed in accordance with the present invention, with a housing shown in phantom lines. Firearm monitoring device **2** includes inertia switch assembly **4**, microcontroller **6**, reset switch **36** (shown above firearm monitoring device **2** for clarity), count adjustment switch **38**, back light on-off switch **40**, and display **10**. Inertia switch assembly **4** is configured to generate an electrical signal, such as by completing an electrical circuit, in response to each time the firearm recoils, which occurs when the firearm is discharged. Inertia switch assembly **4** is electrically connected to microcontroller **6**, which, as described in greater detail below, is adapted to count each such signal. Microcontroller **6** generates an electrical signal which drives display **10**. As described below, back lighting battery **12** and microcontroller battery **14** provide power to firearm monitoring device **2**.

Referring to FIG. **2**, inertia switch assembly **4**, shown in cross-section, includes housing **16**, end **18**, center contact **20**, ball **22** and spring **24**. Center contact **20** is electrically isolated from end **18** by non-conductive material **19**. Housing **16** acts as a guide within which ball **22** and spring **24** are disposed. Housing **16**, which defines the path of movement of ball **22**, is generally aligned with the bore of the firearm to which firearm monitoring device **2** is attached. Alternatively, housing **16** can be formed integrally with the housing (not shown in FIG. **2**) or can be separate as illustrated in FIG. **2**.

When the firearm is discharged, the firearm experiences recoil. Ball **22**, whose mass is substantially smaller than that of the firearm, reacts to the recoil and contacts center contact **20**. Ball **22**, which is metal in the preferred embodiment, completes an electrical circuit from center contact **20**, through ball **22**, spring **24** and/or housing **16**, end **18** to post

25. Center contact **20** and post **25** are electrically connected to microcontroller **6**.

Ball **22** and spring **24** are selected based on the physical characteristics of the firearm and the rounds being discharged so as to close the electrical circuit in response to the recoil of the firearm upon discharge, but preferably not in response to other impacts which the firearm might experience. Preferably, this electrical circuit is closed only once for one discharge of the fire arm, with ball **22** returning to a position adjacent the distal end **26** of housing **16**. However, for production purposes, it is anticipated that a given ball and spring combination will be used for a range of firearms and calibers. Given such a range of firearms and calibers that a given ball and spring combination may have to accommodate, the microprocessor can be programmed to ignore multiple closures occurring within a predetermined period of time which result from any "bounce" of ball **22**. Additionally or alternatively, magnet **27** (shown only in FIG. 2) may be disposed adjacent distal end **26**, creating an additional return force on ball **22**. As should be apparent, in the event that magnet **27** is used, ball **22** must be magnetic and housing **26** non-magnetic. Adjustment screw **28** can be screwed in or out to adjust the distance between ball **22** and magnet **27**. Magnet **27** and adjustment screw **28** may be carried directly by housing for firearm monitoring device **2** or by housing **16**. To increase the range of firearms and calibers which a given ball and spring combination can accommodate, different strength magnets may be made available and provisions made for magnet **27** to be removed from the outside of the housing of firearm monitoring device **2**.

In order to determine the ball and spring set, the amount of recoil of a particular firearm should be determined. This can be done using various empirical methods such as mounting an accelerometer to the firearm, or measuring the displacement and time lapse using high speed photography. In constructing the preferred embodiment, a 45 caliber ACP model 1911 was photographed, showing a travel of 38 mm and a complete lapsed time (displacement and return) of 0.10 seconds. Using this information, a ball and spring combination was selected. The cycle rate of the firearm should also be considered in order to avoid bounce of the ball which would generate multiple closures or resonance of the ball which would not generate the necessary closure.

By aligning the path of movement of the ball with the bore of the firearm, the potential for false counts due to impacts to the firearm is reduced. For example to duplicate the forces which are present in a handgun during recoil, the handgun would have to receive an impact substantially in line with the bore. Any impacts not so in line would have to generate a component in line with the path of movement of the ball sufficient to cause the ball to strike the actuator.

Inertia switch assembly **4** functions as a means for generating a signal in response to substantially each recoil of a firearm. As will be appreciated, there are numerous other equivalent structures which can provide the same functionality. For example, ball **22** could actuate an actuator, which could be a plunger or a device which is merely responsive to the proximal presence of the ball rather than displacement of a plunger. Various other arrangements of the ball and spring design could also be used. For example, the direction of the assembly could be reversed, or the spring located on the opposite side of the ball (with the appropriate change to the location of contact **20**). Instead of a ball and spring arrangement, an accelerometer could be used, with the appropriate circuitry to generate the necessary signal in response each recoil of the fire arm.

Further, as will be readily appreciated, all or part of inertia switch assembly **4**, or any of its equivalents, must be

mounted so as to be responsive to the recoil of the firearm. The other components of firearm monitoring device 2 can be mounted remote from the firearm, which may be advantageous for large caliber or permanently mounted firearms. For handguns, however, the display means needs to be in a convenient location to be observed during use of the handgun.

Microcontroller **6** (not seen in FIG. **2**) is electrically connected to inertia switch assembly **4**, through center contact **20** and post **25**, and as mentioned above, microcontroller **6** receives the signal from inertia switch assembly **4**. Microcontroller **6** is a programmable microcontroller, which has been configured to count the number of signals, or circuit closures it receives from inertia switch assembly **4**. In the preferred embodiment, microcontroller **6** is a Sanyo LC5732N. Microcontroller **6** generates an output signal which is indicative of the number of signals it has received from inertia switch assembly **4**. This output signal drives display **10**, which is connected through flex connector **30**. Display **10** can be any type of visually perceptible display, such as a graphical display or a numeric display. In the preferred embodiment, display **10** includes nine segment, positive LCD **32** and back light **34**, giving a visual indication indicative of the count. Back light **34** is preferably red so as to minimize the loss of night vision when reading LCD **32**. A nine segment LCD was used to minimize size, but larger displays can also be used. Although the preferred embodiment uses a visual display, which continuously displays the count, as used herein, display is not limited to visually perceptible displays, but can include audio displays, such as tones or even spoken numbers, alone or in combination with a visual display. Additionally, the output of microcontroller **6** may be directed to a data collection device, such as a computer, through use of port **48**, which is connected to microcontroller **6** through connector **48***a*. This feature will be particularly useful with large caliber or permanently mounted firearms.

To operate firearm monitoring device **2**, microcontroller **6** is connected to reset switch **36**, count adjustment switch **38** and back light on-off switch **40**. In operation, the user sets the total number of rounds available by depressing count adjustment switch **38**. To prevent accidental resetting, count adjustment switch **38** is preferably configured to require a thin, blunt object, such as a ballpoint pen tip, to depress. Starting from this maximum number, microcontroller **6** will decrease the number on the display each time it receives a signal from inertia switch assembly **4**. Once the display reaches zero, and the firearm has been reloaded, reset switch **36** is depressed, and the count is reset to the maximum. By depressing reset switch **36** and holding it, the display will count down from the maximum number until reset switch **36** is released. This allows the use of a smaller number of rounds without having to reset the maximum number.

Back light on-off switch **40** allows back light **34** to be turned on and off, in order to conserve back lighting battery **12**. It should be noted that, due to the current drain, back lighting battery **12** will not last as long as microcontroller battery **14**. For this reason, back lighting battery **12** is easily accessible through the firearm monitoring device **2** housing (see FIG. **3**). As will be understood, microcontroller battery **14** should also be easily accessible, but it is not anticipated that microcontroller battery **14** will require replacement as frequently as will back lighting battery **12**. Batteries **12** and **14** can be located in alternative locations, such as in the grip of a hand gun. A primary consideration in battery location is the size of available batteries.

Microcontroller **6** also maintains a count of the total number of signals it receives from inertia switch assembly **4**.

Microcontroller **6** is configured to retain this total number in memory even in the event of power loss. As mentioned above, this may be used for maintenance of the firearm. This feature may be provided alone or with the above described ability to count the number of rounds left. Preferably, the total count cannot be reset. Microcontroller **6** could also be configured to provide an additional interval count which could be reset, for example, after each performance of routine maintenance.

In the preferred embodiment, since display **10** is only a nine segment display, the total count beyond 19 cannot be done directly. Thus, in the preferred embodiment, an external display (not shown), preferably capable of displaying at least 5 full digits, is connected to microcontroller **6** through an electrical port. For example, as shown in FIG. **2**, port **48** is diagrammatically indicated. Microcontroller **6** generates the signal required for the external display to display the total count. Such an external display could be made available, for example, to gun stores or manufacturers which could provide access to the total as an additional service. Of course, if a larger display is used on firearm monitoring device **2**, an external display would not necessarily be required. There are numerous other ways to display the total count information, such as by sequential display on display **10** of the individual numerals of the total number.

Also, as mentioned above, microcontroller **6** could be connected to a data collection device or computer, particularly for large caliber or permanent installations, such as military applications. This would allow better management of maintenance and tracking of usage. In such case, microcontroller **6** would be configured to deliver data through port **48**, such as in a generic numeric code format. Additionally, although a wide range of microcontroller can be used, the particular microcontroller selected for the preferred embodiment has excess capacity for additional functions which can be added if desired. For example, the microcontroller selected is capable, with the appropriate additional externals, of displaying compass directions.

Referring to FIG. **3**, firearm monitoring device **2** is shown disposed within housing **42**. Housing **42** is sealed to protect firearm monitoring device **2** from the environment, particularly from solvents which are frequency used for cleaning. For this reason, reset switch **36**, count adjustment switch **38** and back light on-off switch **40** are tactile switches which underlie thin portions **36***a*, **38***a* and **40***a*, respectively, of housing **42**. LCD **32** is protected by lens **44** (FIG. **2**) which is sealed to housing **42**. Back lighting battery access cover **46** is also sealed, as is adjustment screw **26**. Opening **48***b*, which provides access to electrical port **7**, is also sealed. Housing **42** is designed to be attached to the hand grip of a handgun. When used with a handgun, end **50** of housing **42** is angled to permit easier holstering.

Other housing may of course be used, the design of which depends on the specific application. For example, as shown in FIG. **4**, handgrip **52** may comprise the housing for firearm monitoring device **2**. Handgrip **52** may be a universal handgrip, or specific to a particular handgun.

Additionally, in order to discourage tampering with the device, particularly the total count, some type of indicator can be used to indicate whether the housing has been breached. For example, a dye which is responsive to exposure to air could be applied prior to sealing within the housing.

As will be appreciated, when firearm monitoring device **2** is used with a handgun or rifle, size and location are of prime importance. Firearm monitoring device **2** can be mounted at

any appropriate location on the firearm, preferably so long as display **10** is easily visible. For larger firearms, size and location may become less important. As will be appreciated, microcontroller **6** and display **10** do not have to be mounted to the firearm. The present invention can also be adapted for use on devices other than firearms to count cycle rates, so long as there is sufficient acceleration/movement of the device to cause the invention to generate a signal in response to the acceleration/movement. For example, the present invention could be used to count the closing of a door, or other repetitive movement of almost anything.

In summary, numerous benefits have been described which result from employing the concepts of the invention. The foregoing description of a preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Obvious modifications or variations are possible in light of the above teachings. The embodiment was chosen and described in order to best illustrate the principles of the invention and its practical application to thereby enable one of ordinary skill in the art to best utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto.

I claim:

1. A firearm monitoring device for attaching to a firearm, said firearm having a firing end and a grip end, and said firearm being susceptible to recoil when discharged, comprising:

a) first means for creating a first signal in response to substantially each recoil of said firearm; and

b) second means for receiving each said first signal and generating a second signal indicative of the number of said first electrical signals received by said second means;

wherein said first means comprise an inertia switch comprising a movable mass; and wherein said mass is resiliently biased toward the firing end of the firearm.

2. The device of claim **1** comprising display means for receiving said second signal and generating a display in response to said second signal.

3. The device of claim **2** wherein said display is an audible display.

4. The device of claim **2**, wherein said display is positioned such that it is visible to a user of the firearm while firing in a direction away from the user.

5. The device of claim **1**, the movement of said mass being generally confined to movement along a straight line.

6. The device of claim **5** wherein said firearm includes a bore through which a round of ammunition is discharged, said straight line being generally parallel to said bore.

7. The device of claim **1** wherein said second means include means for counting down by one in response to each said first signal beginning from a predetermined number.

8. The device of claim 7 wherein said second means include means for changing said predetermined number.

9. The device of claim 1 wherein said second means include means for maintaining a total count of the number of said first signals received from said first means.

10. The device of claim 1 wherein said second means comprise a microcontroller adapted to count each said first signal received by said microcontroller.

11. The device of claim 10 wherein said second means further comprise a communication port, wherein information may be stored in and accessed from the microcontroller via the communication port.

12. The device of claim 1 wherein the removable mass is detached and free-floating.

13. The device of claim 1, wherein the inertia switch comprises a substantially cylindrical housing and a spring.

14. A firearm in combination with a monitoring device, said firearm having a firing end and a grip end, and said firearm being susceptible to recoil when discharged, said monitoring device comprising:

a) first means for creating a first signal in response to substantially each recoil of said firearm; and

b) second means for receiving each said first signal and generating a second signal indicative of the number of said first electrical signals received by said second means;

wherein said first means comprise an inertia switch comprising a movable mass; and wherein said mass is resiliently biased toward the firing end of the firearm.

15. The combination of claim 14 wherein said firearm includes a bore through which a round of ammunition is discharged, and the movement of said mass being generally confined to movement along a straight line generally parallel to said bore.

16. The combination of claim 14 wherein said second means include means for counting down by one in response to each said first signal beginning from a predetermined number.

17. The combination of claim 16 wherein said second means include means for changing said predetermined number.

18. The combination of claim 14 wherein said second means include means for maintaining a total count of the number of said first signals received from said first means.

19. The combination of claim 14 wherein said second means comprise a microcontroller adapted to count each said first signal received by said microcontroller.

20. The combination of claim 19 wherein said second means further comprise a communication port, wherein information may be stored in and accessed from the microcontroller via the communication port.

21. The device of claim 14 wherein the movable mass is detached and flee-floating.

ABSTRACT

A firearm monitoring device has first means which generate a first signal in response to each recoil of the firearm and second means which receive the first signal and generate a signal which is indicative of the number of first signals received by the second means. More particularly, the firearm monitoring device has an inertia switch, which is mounted to the firearm, which generates a signal in response to recoil of the firearm. The signal is counted by a microcontroller which generates an output signal for delivery to a display or data collection device. The output signal can indicate the number of rounds left to be discharged, based on an initial number preset by the user, and can indicate the total number of rounds discharged by the firearm during its life. Additional controls are provided which allow the user to temporarily decrease the beginning number for the countdown.

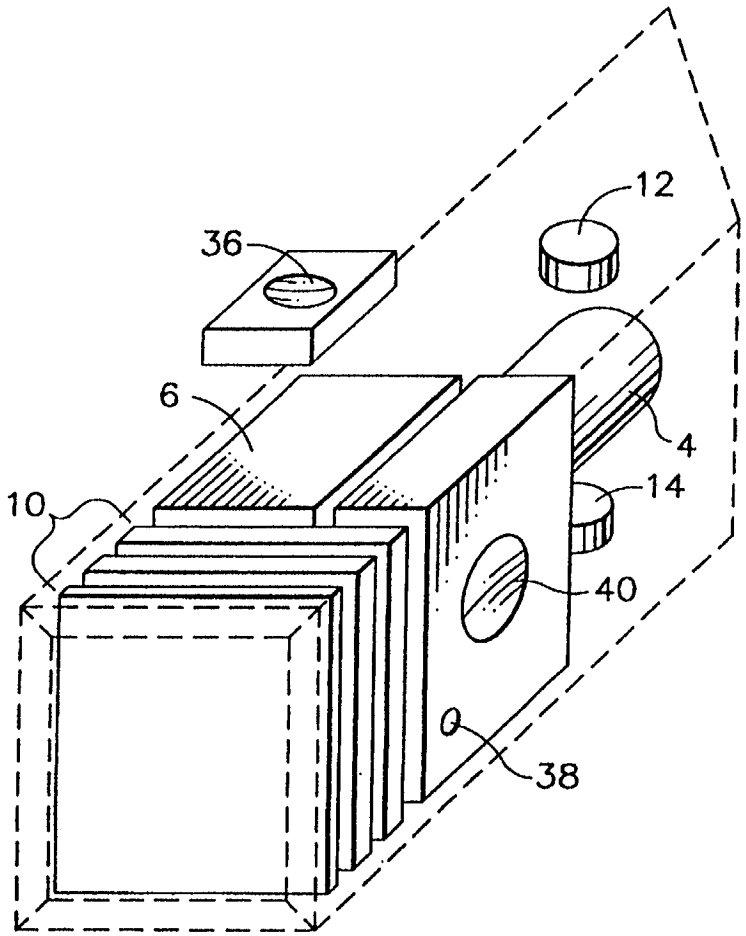

FIG. 1

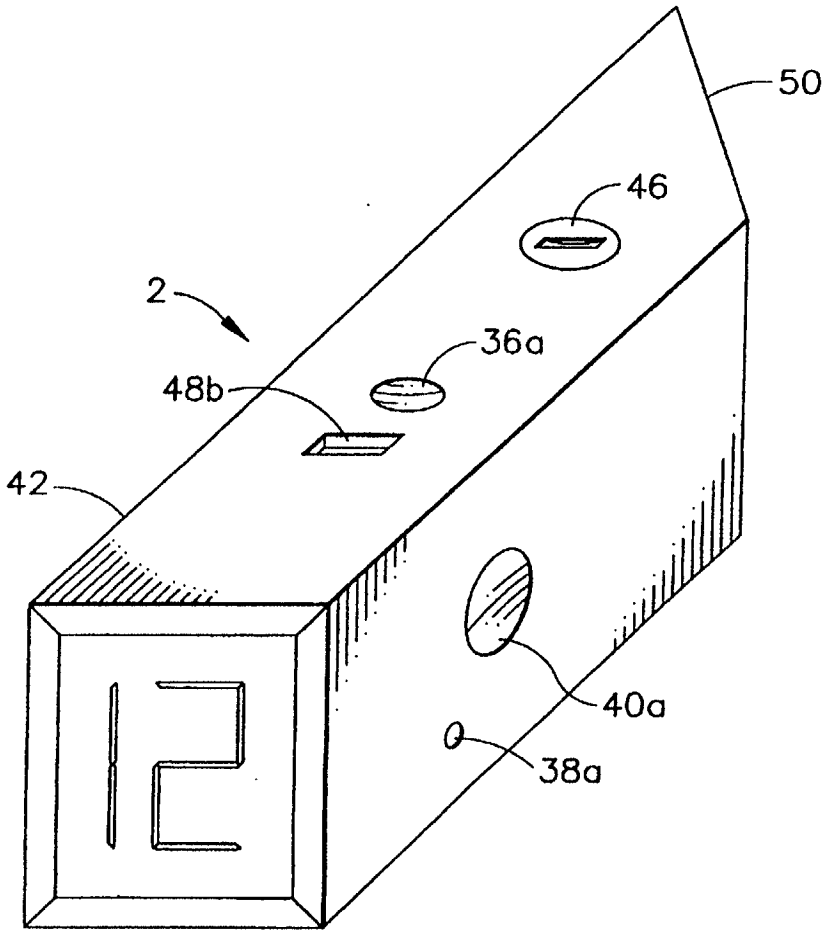

FIG. 3

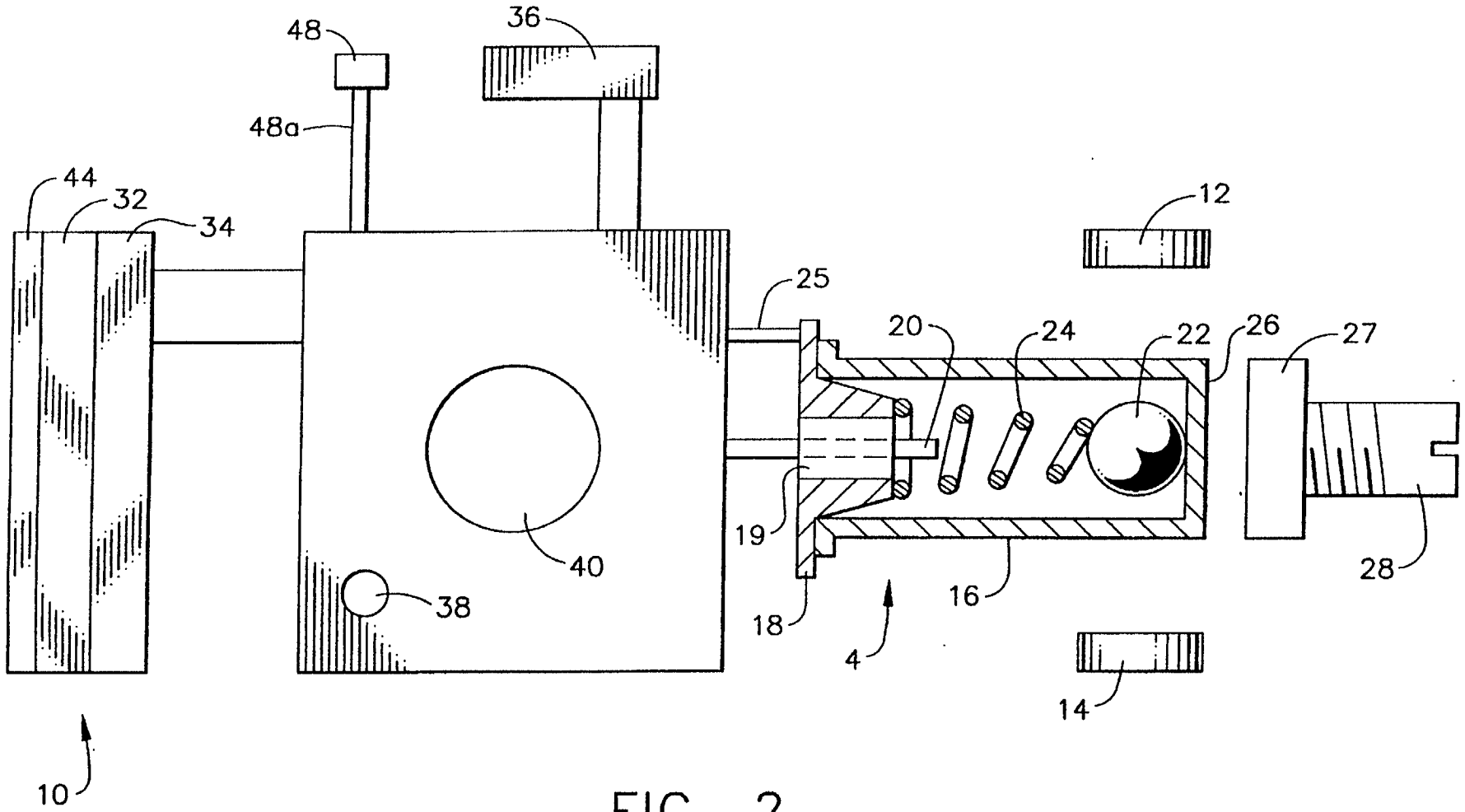

FIG. 2

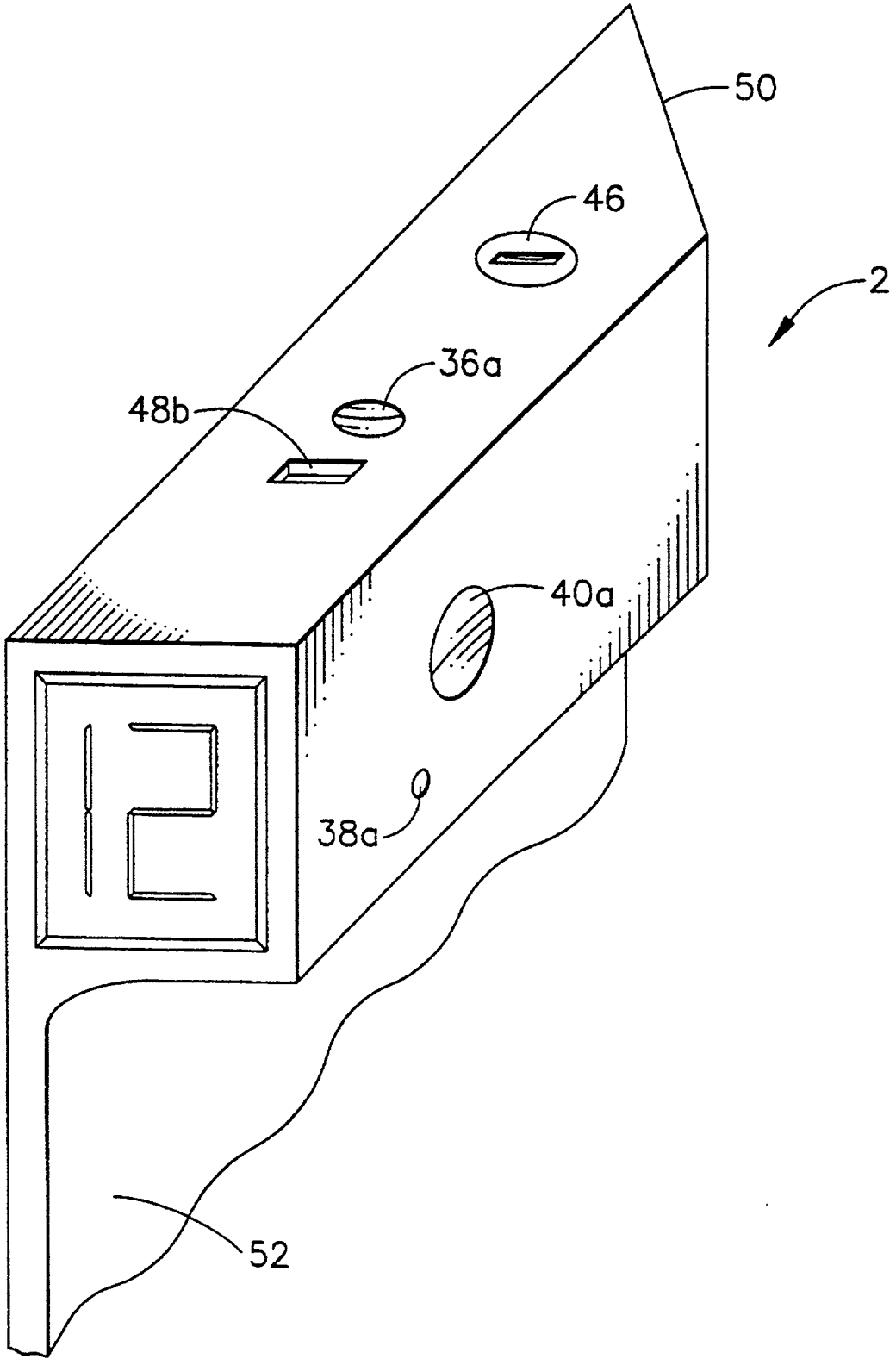

FIG. 4

REISSUE DECLARATION AND POWER OF ATTORNEY BY THE INVENTOR

As below named inventor, I hereby declare that:

My residence, post office address and citizenship is as stated below next to my name.

I believe that I am the original and first inventor of the subject matter which is described and claimed in patent number 5,566,486, granted October 22, 1996, and for which a reissue patent is sought on the invention entitled Firearm Monitoring Device, the specification and Preliminary Amendment of which

(check one) ☒ is attached hereto.

☐ Was filed on _____ as Application Serial No. _____ and was amended on _____.
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I verily believe the original patent to be wholly or partly inoperative or invalid, for the reasons described below. (Check all boxes that apply.)

☐ by reason of a defective specification or drawing.
☒ by reason of the patentee claiming more or less than he had the right to claim in the patent.
☒ by reason of other errors.

The errors upon which reissue is based are described as follows:

1) DEFECT: Applicant failed to claim as much as he had a right to claim in claims 1 and 14.

HOW THE DEFECTS AROSE: These defects arose by not fully recognizing the scope of the limitations of the claims as originally filed.

WHEN THE DEFECTS AROSE: These defects arose in part during drafting the claims which became issued claims 1 and 14, and in part during the prosecution of the original patent application.

HOW THE DEFECTS WERE DISCOVERED: These defects were discovered as the result of on going discussions with the inventor regarding additional improvements to the invention (such improvements do not form any part of the original patent or this reissue application).

WHEN THE DEFECTS WERE DISCOVERED: The defects were first suspected as of May, 1997. Additional general reviews of the patent and prior art were subsequently undertaken. These reviews confirmed that the claims were narrower than necessary, although the exact nature and extent of the defects were not known or fully appreciated until the preparation of this reissue application.

2) DEFECT: Applicant failed to claim as much as he had a right to claim, as is now covered by new claims 22-31.

HOW THE DEFECT AROSE: This defect arose by not fully recognizing the scope of the limitations of the claims as originally filed.

WHEN THE DEFECT AROSE: This defect arose in part during drafting of the claims of the original application, and in part during the prosecution of the original patent application.

HOW THE DEFECTS WERE DISCOVERED: These defects were discovered as the result of on going discussions with the inventor regarding additional improvements to the invention (such improvements do not form any part of the original patent or this reissue application).

WHEN THE DEFECTS WERE DISCOVERED: The defects were first suspected as of May, 1997. Additional general reviews of the patent and prior art were subsequently undertaken. These reviews confirmed that the claims were narrower than necessary, although the exact nature and extent of the defects were not known or fully appreciated until the preparation of this reissue application.

3) DEFECTS: The lack of antecedent basis for certain terms in claims 7, 8, 9, 10, 11, 13, 16, 17, 18, 19, 20 and 21, and various typographical, punctuation and/or grammatical errors evident from the Preliminary Amendment.

HOW THE DEFECTS AROSE: The lack of antecedent basis errors arose due to the amendment of claims 1 and 14 in this reissue. The typographical, punctuation and/or grammatical errors arose through inadvertence during the preparation and prosecution of the original application.

WHEN THE DEFECTS AROSE: The lack of antecedent basis errors arose during the preparation of this reissue application. The typographical, punctuation and/or grammatical errors arose during drafting of the claims of the original application.

HOW THE DEFECTS WERE DISCOVERED: These defects were discovered by reviewing these claims after the amendment of claims 1 and 14 were prepared.

WHEN THE DEFECTS WERE DISCOVERED: These defects were discovered during the preparation of this reissue application.

4) DEFECT: Grammatical corrections to claims 5 and 15, evident from the Preliminary Amendment.

HOW THE DEFECTS AROSE: The defects arose through inadvertence during the preparation and prosecution of the original application.

WHEN THE DEFECTS AROSE: The defects arose during the preparation of this reissue application.

HOW THE DEFECT WAS DISCOVERED: These defects were discovered by reviewing these claims during preparation of this reissue application.

WHEN THE DEFECT WAS DISCOVERED: These defects were discovered during the preparation of this reissue application.

5) DEFECTS: The original title does not completely reflect the scope of the claims as added in this reissue.

HOW THE DEFECT AROSE: The defect arose due to the amendment and addition of claims in this reissue.

WHEN THE DEFECT AROSE: The defect arose during the preparation of this reissue application.

HOW THE DEFECT WAS DISCOVERED: The defect was discovered by reviewing the patent during the preparation of this reissue application.

WHEN THE DEFECT WAS DISCOVERED: The defect was discovered during the preparation of this reissue application.

6) DEFECTS: Various typographical, punctuation and/or grammatical errors in the specification, evident from the Preliminary Amendment.

HOW THE DEFECTS AROSE: The typographical, punctuation and/or grammatical errors arose through inadvertence during the preparation and prosecution of the original application.

WHEN THE DEFECTS AROSE: The typographical, punctuation and/or grammatical errors arose during drafting of the specification of the original application.

HOW THE DEFECTS WERE DISCOVERED: These defects were discovered by reviewing the patent during the preparation of this reissue application.

WHEN THE DEFECTS WERE DISCOVERED: These defects were discovered during the preparation of this reissue application.

7) DEFECTS: Figure 2 does not contain the reference numeral "30".

HOW THE DEFECT AROSE: The defect arose through inadvertence during the preparation of the drawings as originally filed. The defect was duplicated in the formal drawings.

WHEN THE DEFECT AROSE: The defect arose when the original drawings were prepared.

HOW THE DEFECTS WERE DISCOVERED: These defects were discovered by reviewing the patent during the preparation of this reissue application.

WHEN THE DEFECTS WERE DISCOVERED: These defects were discovered during the preparation of this reissue application.

All errors corrected in this reissue application arose without any deceptive intention on the part of the applicants.

I hereby appoint Edwin R. Acheson, Jr., Registration No. 31,808; Gibson R. Yungblut, Registration No. 20,581; David E. Schmit, Registration No. 28,472; Ann G. Robinson, Registration No. 39,820; Steven J. Goldstein, Registration No. 28,079; Rustan J. Hill, Registration No. 37,351; Kevin S. Sprecher, Registration No. P-42,165, and Sean P. Hodge, Registration No. P-41,842; c/o Frost & Jacobs LLP, 2500 PNC Center, 201 East Fifth Street, Cincinnati, Ohio 45202 (513) 651-6800 my attorneys, with full power in each of them, of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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